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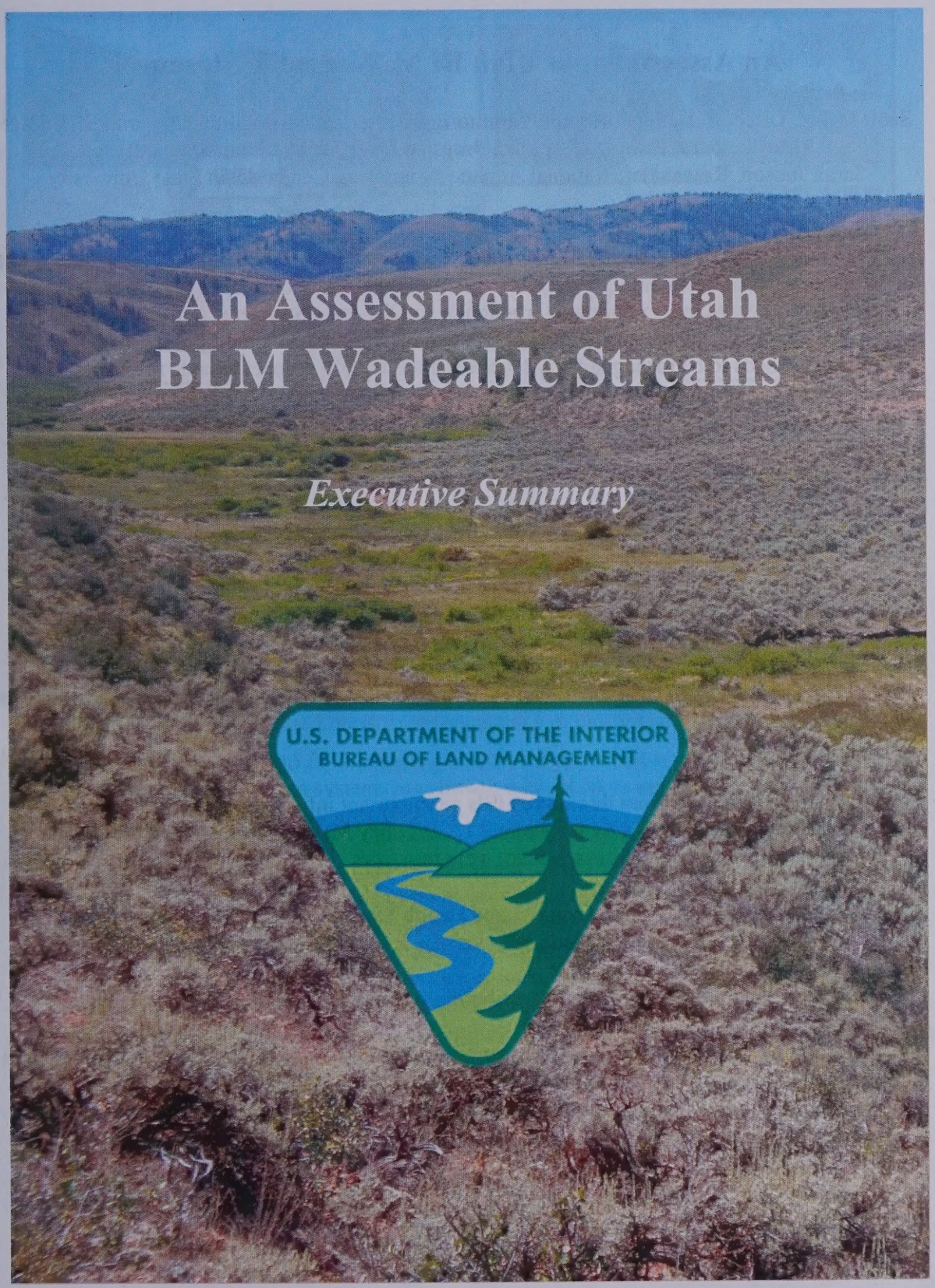

An Assessment of Utah BLM Wadeable Streams

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Executive Summary
The Bureau of Land Management (BLM) oversees approximately 92,202 km^2 of land throughout the State of Utah (UT) containing over 5,200 km of perennial streams. BLM stream and riparian systems are among the most important, productive and diverse ecosystems in the State, which support a diversity of aquatic species and ecosystem services. BLM's multiple-use mandate also requires watersheds to be managed for activities that potentially impact aquatic resources, such as livestock grazing, timber harvest, mining, energy development and recreation. Consequently, knowing the condition and trend of aquatic systems is critical to achieving the Bureau's mission of "sustaining the health, diversity and productivity of public lands for the use and enjoyment of present and future generations".

Historically, BLM field offices lacked a cost-effective monitoring program to assess aquatic Land Health Standards in a consistent, quantitative manner at multiple spatial scales (e.g., individual sites, resource management plans [RMP], state level). To overcome this problem, the Fisheries, Riparian and Soil, Water and Air Programs worked collaboratively with the BLM's Assessment, Inventory and Monitoring Strategy (AIM) to implement the Bureau's first AIM – National Aquatic Monitoring Framework (AIM-NAMF) project. Standardized indicators, quantitative sampling methodologies and a statistically valid sampling design were used to assess the attainment of BLM's aquatic and to a lesser extent riparian Land Health Standards at multiple spatial scales.

The information generated from this survey fills an important information gap in meeting monitoring requirements set out by the Federal Land Policy Management Act and the Clean Water Act. The objectives of this assessment were to:

- Determine whether Utah Aquatic Land Health Standards (e.g., Water quality, Geomorphic processes, Aquatic biodiversity, Riparian processes) are attained at the State and District scales.
- Identify and rank the stressors contributing to degraded conditions, if standards are not attained.
- Prioritize adaptive management strategies and identify aquatic and riparian areas of high conservation or restoration potential.
- Inform the development of the BLM's National Aquatic Monitoring Framework under the AIM Strategy.

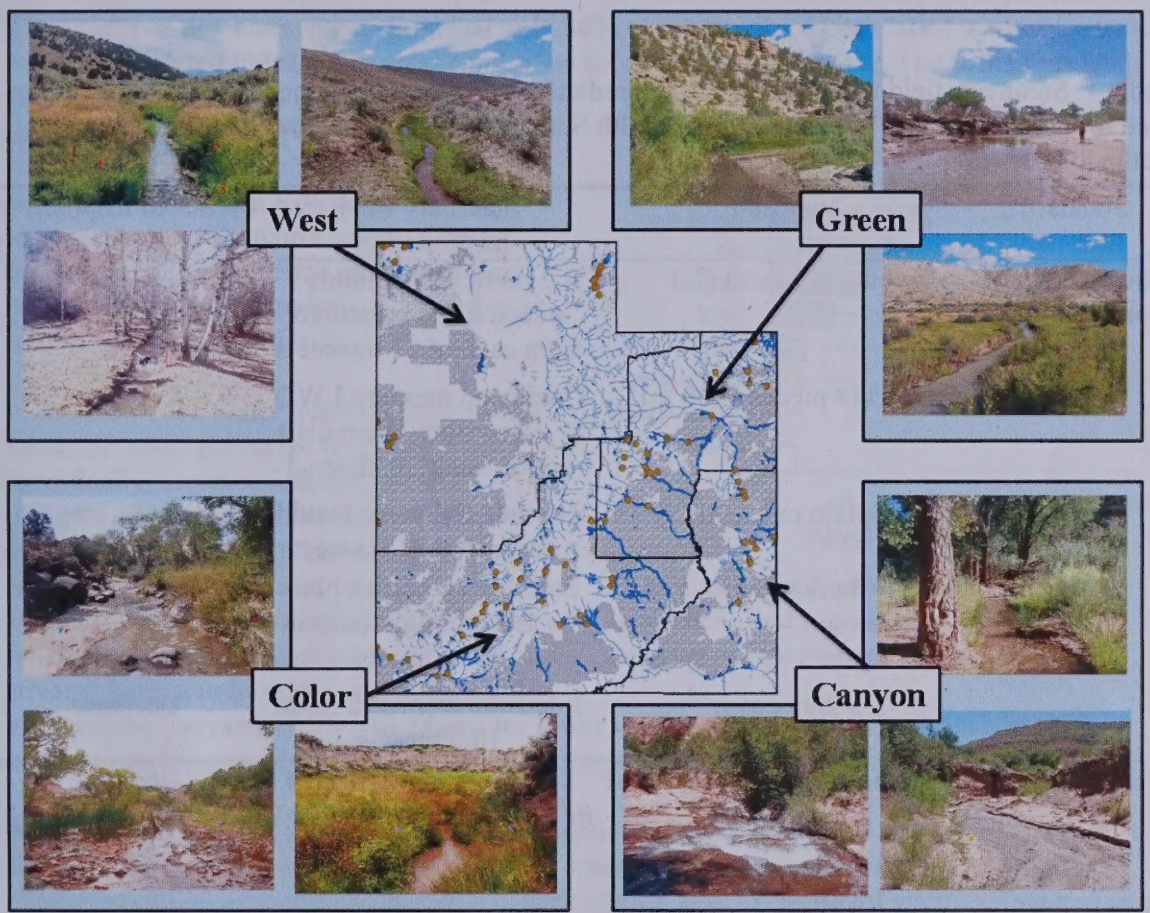

Figure 1. Map of the 2011 and 2012 sample sites (brown points) across the four UT BLM districts. Only perennial stream systems are shown, with BLM streams highlighted in darker blue. BLM lands are indicated by grey stippling.

To derive estimates of the percent of UT BLM stream kilometers in least, moderate and most disturbed condition, with known levels of precision and accuracy, we selected a random subset of stream reaches for sampling using a random or probability-based survey design. Specifically, we used a spatially balanced, randomized survey design to select 77 stream reaches from the target population of 2-5th order perennial stream systems occurring on Utah on BLM lands (Fig. 1). The 77 sample sites were stratified by BLM district (~20 per district) and allocated in proportion to the linear extent of streams by Strahler stream order. Sites were sampled during the summers of 2011 and 2012 using aquatic macroinvertebrates as the primary indicator of biological condition, while a suite of ancillary environmental variables were measured to assess the watershed function, both instream and riparian, and water quality Standards (Table 1). From this set of field measurements, we computed chemical, physical and biological indicators of Land Health.

Table 1. Summary field methodologies and predicted response to disturbance for the indicators used to assess Utah BLM's aquatic Land Health Standards. Unless otherwise noted, field methodologies followed Archer et al., 2012.

Standard	Indicator	Summary field methodology	Predicted response to disturbance
Stream channel and riparian function	Fine sediment (%)	5 particles randomly selected and measured from each of 21 transects	Increase
	LWD (# pieces / 100 m)[1]	Count and measure LWD (> 1 m length;10cm dia.) within bankfull channel	Decrease
	Floodplain connectivity[1,3]	Bankfull and wetted width measured at 21 transects	Decrease
	Bank stability	Stability and cover plots for left and right bank at 21 transects	Decrease
	Canopy cover[1,2]	3 densiometer readings at 10 transects	Decrease
Desired species	Macroinvertebrate biological integrity (O/E)	8 Surber samplers (0.74 m^2) from first 4 riffles or 8 transects	Decrease
	Invasive benthic macroinvertebrates	See macroinvertebrate protocol above	Increase
Water quality	Macroinvertebrate biological integrity (O/E)	See macroinvertebrate protocol above	Decrease
	Water temperature (°C)	Hobo thermistors: July 15th – Sept. 15th	Increase
	Conductivity (µS/cm)	Single, in-situ YSI measurement	Increase
	Total nitrogen and phosphorous (µg/L)[3]	Water sample collected for lab processing	Increase

[1]Indicator only measured in 2012

[2]Field methodology followed SWAMP, 2007

[3]Field methodology followed USEPA, 2009

The results of this assessment show that only 36% of the length of Utah BLM wadeable streams can be considered in least disturbed conditions across all indicators (Fig. 1). Of the four Utah BLM districts, streams in the West Desert appear to be in the best condition (Fig. 3), with 60% of streams in least disturbed condition. The Green River District, and to a lesser extent the Canyon Country District, present the most concerns, with more than 70% of the length of streams estimated to be in most disturbed condition.

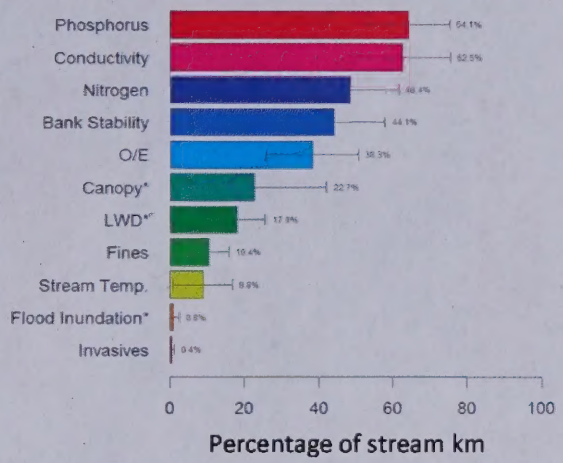

Figure 1. Linear extent of stream kilometers experiencing most degraded chemical, physical or biological condition for Utah BLM streams.

Across the state, water quality impacts were by far the most pervasive (Fig. 3); specifically, elevated levels of total phosphorous, nitrogen and salinity (64, 48 and 62%, respectively). More than 30% of stream kilometers were in degraded biological condition, as indicated by aquatic macroinvertebrate assemblages. Riparian and stream channel indicators generally scored well with no pervasive concerns except for lower than expected stream bank stability and isolated occurrences of low canopy cover and large woody debris in the stream channel.

As a first step towards identify the land uses associated with departures from the Land Health Standards (i.e., a determination), we modeled spatial variation in indicators (e.g., total phosphorous and nitrogen, conductivity, bank stability and macroinvertebrate O/E scores) as a function of anthropogenic impacts using data layers generated from the BLM's Rapid Ecoregional Assessments. Preliminary results show excessive conductivity as the most predictable indicator (65% variance explained), with conductivity exceedances increasing with greater percentages agricultural land use, the density of oil and gas wells and the length of hydrologically altered stream kilometers (Fig. 2).

Our next steps are to: 1. Supplement data from this assessment with similar data collected by the Utah Department of Environmental Quality and additional AIM sampling; 2. Work with individual districts and field offices to implement the AIM-NAMF monitoring for land-use plan effectiveness monitoring; 3. Identify the likely anthropogenic sources for observed water quality impacts; and 4. Complete a similar assessment for Grand Staircase-Escalante National Monument.

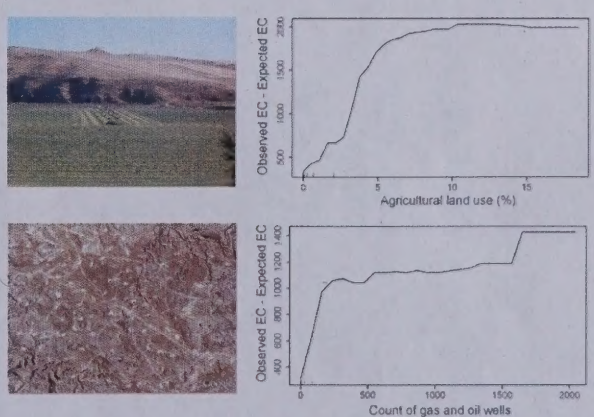

Figure 2. Modeled relationships between percent agricultural land use in a watershed and excessive conductivity concentrations (top) and the number of oil and gas wells and excessive conductivity (bottom).

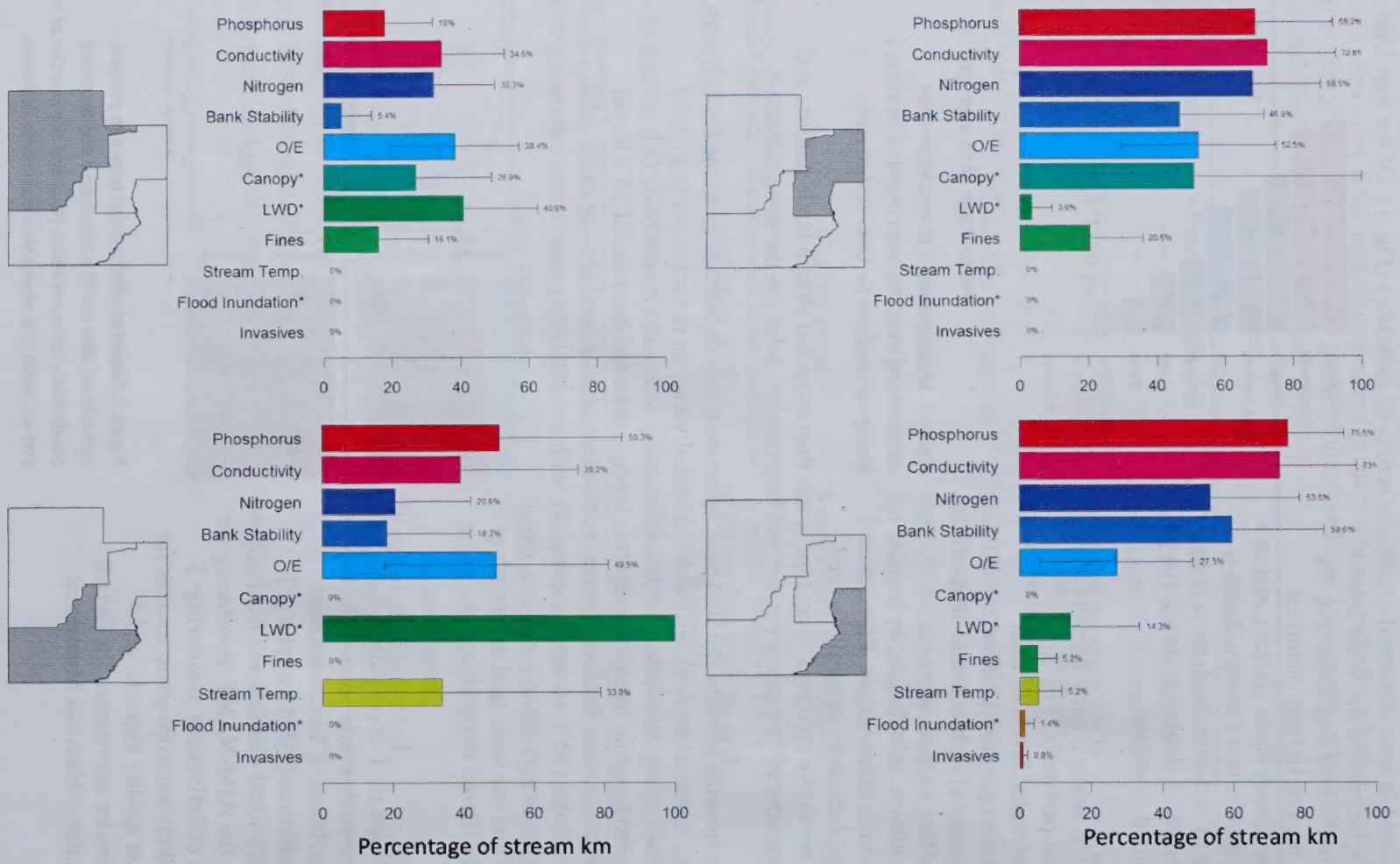

Figure 3. The linear extent of stream kilometers experiencing most degraded chemical, physical or biological condition by Utah BLM Districts. The order of the indicators is set by the relative extent for the state-wide estimates.